Thermal Printer Mechanism

PT48GE

Specification

SUPPLIER		
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2019.11.08	2019.11.08	2019.11.08

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Thermal Printer Mechanism

PT48GE *series*

PRT will execute the PCN procedure before change any specifications or materials related to this mechanism.There will be no changes before the acknowledge and confirmation of our client.

The latest version of the specification will be sent to the client for confirmation if any change has been agreed.

PRT continuously promotes new products and we also provide ODM service,if there is any need,please contact us at anytime.

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REVISION RECORDS

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PT48GE is the model name,
18 indicates the year 2018,
36 indicates the 36th week,
00006 indicates the five-digit serial number, the trace code.

CHAPTER 1 CHARACTERS AND OPERATING PRECAUTIONS

1.1 Characters

- **Supply voltage range**

  The range of heating operation voltage is2.7V～5.0V and the range of logic voltage is 4.2～8.5V.

- **Compact and light**

  The mechanism is compact and light,
  dimensions: 69.3mm (width) * 46mm(depth) * 19mm (high).

- **High resolution printing**

  A high-density printer head of 8 dots/mm make the printing clear and precise.

- **Printing speed adjustable**

  1.1-A

  According to driving power and sensitivity of thermal paper, set different printing speed required.The max speed is 150mm/s.

- **Easy paper loading**

  Detachable rubber roller structure makes the paper loading easier.

- **Low noise**

  Thermal line dot printing is used to guarantee low-noise printing.

1.2 Operation Precautions

1）TPH and photo interrupter is sensitive to static electricity,in order to prevent damages of inner parts of the printer caused by the static electricity,When handling this printer,please take any preventive measures against static electricity, such as disposable static wrist strap.

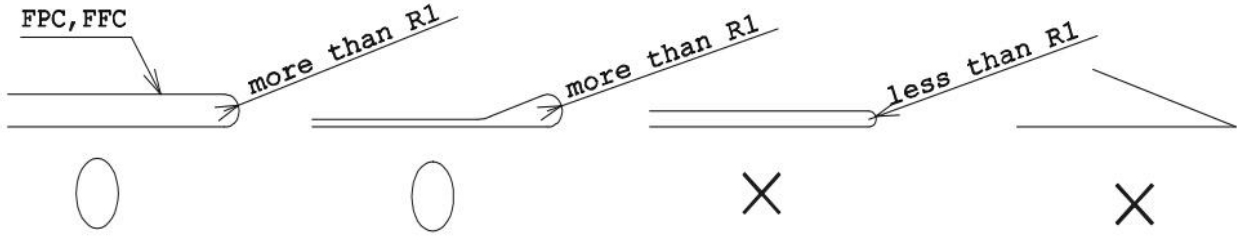
2）When attaching the platen part to the platen retainer, pay attention not to flaw or damage or smear the rubber part of the platen, the platen gear, and the bearing part (particularly, don't attach any oil or grease and foreign materials on the rubber part.)

3）Never attempt to touch the thermal printer head surface with bare hands. Attaching any oil or grease such as oils from palms on the heating element part of may be shortening the lifetime of the thermal head. In case that any oil and grease or foreign materials are attached on it. Perform the cleaning immediately.In addition, pay attention not to hit it with something hard such as driver.

4）When assemble the platen to the platen retainer of the casing, make sure that the orientation is correct.

5）The thermal head and FPC are shipped as they are connected. When installing the printer, do not pull or apply any extra force in order to avoid the connected part of the thermal head and FPC from being disconnected or deviated. When connecting FPC, please make it sure under condition that the power of control circuit is off. Plug in / out FPC to control board, should less than 10 times, meanwhile make FPC parallel to connector socket.

6）Do not make FPC bend because it may cause FPC disconnection or broken. If FPC requires to be bent, the bending should be more than R1,and do not rework (straighten or bend backward).



7）The printer has a structure such that the platen part is removed from the printer cabinet. Therefore, if any paper ejected from this printer is pulled away with an unnecessarily strong force, it may cause the platen gear to get off the track and damage the gear. Do not attempt to pull any paper ejected from the printer.

8）If any voltage is applied to the thermal head when the head or paper is wet due to condensation, it may be damaged by electrolytic corrosion; therefore, when using the printer, pay attention to the following items.

- ❖ Do not apply any electric power to the printer when it is not used.
- ❖ Do not perform the printing with any wet paper.
- ❖ Do not apply any electric power to the printer under any environment where any dew condensation is possible to occur.
- ❖ Turn off all electric power to the head immediately when condensation occurs. Use the head only after the head is completely dried.
- ❖ Depending on the environment where the printer is used (the low temperature or high humidity), condensation may be caused by water vapor generated from the used paper when performing the printing of the high printing rate (solid fills, zigzag printing); therefore, the environment should be considerably evaluated.

9）When using this mechanism for the continuous actions, the temperature of the head (the temperature detected with the thermistor) should be equal or less than 75 degrees.

10）Keep the paper conveyance unobstructed.

11）Use the high quality thermal paper, for the property of the paper have big effect on printing quality. The perforated paper may cause the damage to the thermal heads and even shorten lifetime.

CHAPTER 2 SPECIFICATIONS

2.1 General Specifications

Item	Specifications
	PT48GE
Print method	Thermal dot line printing
Dots per line	384 dots
Resolution	8 dots/mm
Print width	48 mm
Paper width	57.5±0.5mm
W * D * H（mm）	69.3 * 46 * 19
Maximum printing speed	150 mm/s 1.1-A
Paper feed pitch	0.0625mm
Recommended Paper	PD160R (Oji Paper)
Head temperature detection	Via thermistor
Out-of-paper detection	Via photo interrupter
Life span (at 25℃ and rated energy) Activation pulse resistance Abrasion resistance	100 million pulses or more (print ratio=12.5%) 50 km or more
Operating temperature range (℃)	-10～+50
Operating humidity (RH)	20％～85％
Storage temperature range (℃)	-20～＋60
Storage humidity（RH）	5%～90%

2.2 Heat Element Dimensions

PT48GE contains a thermal head with 384 heat elements.

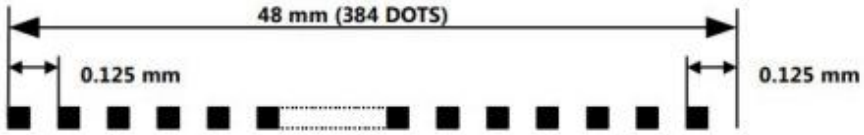


Figure 2-1 Heat Element Dimensions

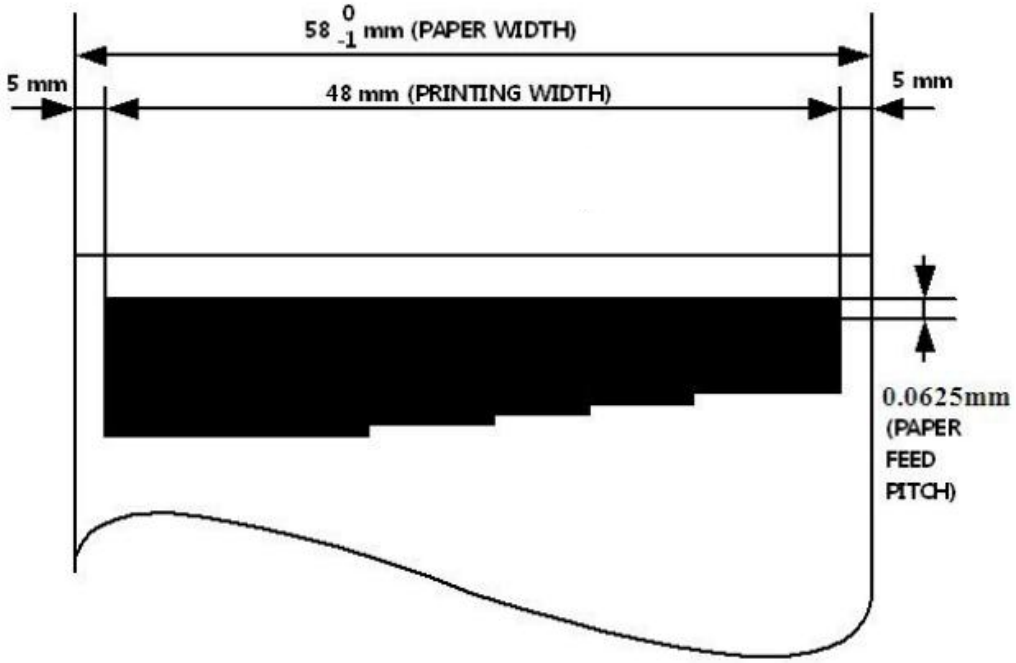


Figure 2-2 Print Area

2.3 Step Motor Characteristics

Item	Specification
Model Name	OT-SM15P-270A
Supplier	Shenzhen City Once Top Motor Manufacture Co.,Ltd.
PRT Material No.	01.T.M.15270002

2.3.1 Step Motor Specifications

Item	Specification
Type	PM
Number of phases	2-phase
Excitation	2-2 phase
Winding resistance per phase	5.5Ω±7%
Rated voltage	4.2～8.5V
Drive current	500mA
Drive frequency	1920pps

2.3.2 Excitation Sequence

Signal name	Sequence			
	STEP1	STEP2	STEP3	STEP4
A	high	low	low	high
$\overline{A}$	low	high	high	low
B	low	low	high	high
$\overline{B}$	high	high	low	low

2.3.3 Accelerate Time Table

STEP	Time (ms)	STEP	Time (ms)	STEP	Time (ms)	STEP	Time (ms)
1	9.250	27	1.364	53	1.023	79	0.750
2	8.250	28	1.344	54	1.013	80	0.740
3	7.760	29	1.322	55	0.990	81	0.730
4	6.250	30	1.302	56	0.980	82	0.720
5	5.760	31	1.282	57	0.970	83	0.710
6	4.250	32	1.262	58	0.960	84	0.700
7	3.760	33	1.242	59	0.950	85	0.694
8	3.459	34	1.222	60	0.940	86	0.690
9	2.762	35	1.202	61	0.930	87	0.680
10	2.314	36	1.191	62	0.920	88	0.670
11	2.028	37	1.181	63	0.910	89	0.660
12	1.928	38	1.171	64	0.900	90	0.650
13	1.828	39	1.161	65	0.890	91	0.640
14	1.728	40	1.151	66	0.880	92	0.630
15	1.675	41	1.141	67	0.870	93	0.625
16	1.635	42	1.131	68	0.860	94	0.620
17	1.595	43	1.121	69	0.850	95	0.610
18	1.565	44	1.111	70	0.840	96	0.600
19	1.543	45	1.103	71	0.830	97	0.590
20	1.523	46	1.093	72	0.820	98	0.580
21	1.503	47	1.083	73	0.810	99	0.570
22	1.486	48	1.073	74	0.800	100	0.560
23	1.466	49	1.063	75	0.790	101	0.550
24	1.426	50	1.053	76	0.780	102	0.540
25	1.406	51	1.043	77	0.770	103	0.530
26	1.384	52	1.033	78	0.760	104	0.520

2.4 Thermal Head Specifications

Item	Specification
Model Name	EF48NL-8798/HHIK 8798B
Supplier	Shandong Hualing Electronics Co.Ltd(SHEC)
PRT Material No.	01.T.T.87980001

2.4.1 General Characteristics

Item	Specification	Note
Print width	48 mm	
Number of heater elements	384 dots	
Heater resolution	8 dots/mm	203dpi
Heater pitch	0.125 mm	
Heater resistance	$\overline{R}$ =140Ω ±3%	
Number of data inputs	1 serial input	Data In
Logic signals	1 STROBE and 1 $\overline{LATCH}$	
Logic power supply	5.0 V × 60 mA	At 8 MHz
Heater print voltage	7.2V	
Specification for Thermistor	R_{25}=30K Ω ±5%,B=3,950K±3%	See 2.4.8

2.4.2 Maximum Parameter

Parameter	Symbol	Specification		Note
Heater energy consumption	Eo max	1.25ms/line	0.83ms/line	Ta=25℃
		0.22mJ/dot	0.15mJ/dot	
Head voltage	VH max	10.0 V		TPH Connectors
Logic voltage	VDD max	5.5V		
Number of heating dots simultaneously ON	Ndot max	192 dots		
Operating temperature	Ta	-10 ℃ ～ +50 ℃		Non-condensing
Storage temperature		-40 ℃ ～ +80 ℃		
Operating humidity		10～90%RH		Non-condensing
Storage humidity		5～90 %RH		
Maximum operating temperature	Ts	Continuous:65° C 30min. MAX.		
		Peak75° C Thermistor temp.		Printing must be stopped, and wait until 60° C

NOTE:On the above conditions,TPH can't ensure the printing quality and life.
*:In the temperature which is out of range(+5°C~+40 °C),it will influence the printing quality.

2.4.3 Characteristics Recommended

Item		Symbol	Recommended conditions		Note
Print Speed			1.25ms/line	0.83ms/line	
Heater power consumption		Po	0.29 W/dot		$\overline{R}$ =140Ω
Heat voltage		VH	7.2V		TPH Connectors
Heater energy consumption	5℃	Eo (ts)	0.24mJ/dot(0.83ms)	0.20mJ/dot(0.69m)	$\overline{R}$ =140Ω See 2.4.7
	25℃		0.22mJ/dot(0.76ms)	0.18mJ/dot(0.62m)	
	40℃		0.20mJ/dot(0.69ms)	0.16mJ/dot(0.55m)	
Supply current		Io	45.5mA/dot		

2.4.4 Electrical Characteristics

1) Limited parameter

Item	Symbol	Text condition	Rated value	Unit
Supply voltage	VDD	Surge	0～7	V
	VH	Surge	0～10	V
Logic input voltage	V_{IN}		0～VDD+0.5	V
Drive supply current	I_{DOL}		70	mA

2) Recommended parameter

Item	Symbol	Text condition	Reference			Unit
			Min.	Typ.	Max.	
Supply voltage	VDD		2.7	5.0	5.5	V
	VH		—	—	8.5	V
Logic input voltage	V_{IH}		0.8*VDD	—	VDD	V
	V_{IL}		0	—	0.2*VDD	V
Clock frequency	f_{clk}	Duty 50%	—	—	10	MHz

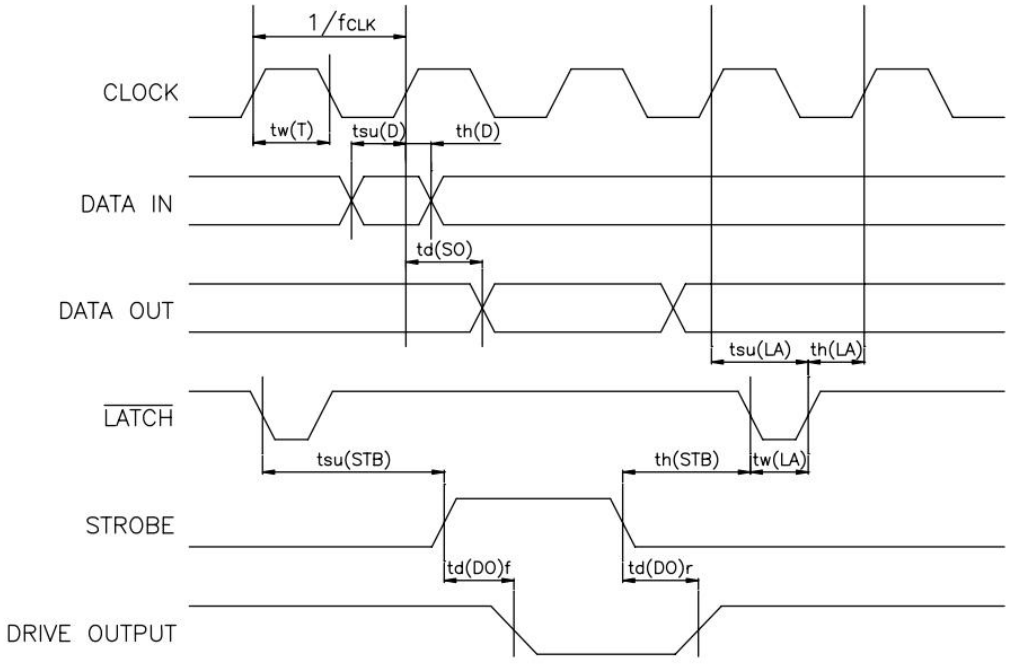
3) Electrical characteristics

Item		Symbol	Test conditions	Min.	Typ.	Max.	Unit
Logic input current	$\overline{LATCH}$	I_{IH}	$V_{IH=}$ V_{DD}	-		3.0	μA
	STROBE			-	-	330	
	CLOCK			-	-	3.0	
	DATAIN			-	-	0.5	
	$\overline{LATCH}$	I_{IL}	V_{IL}=GND	-330	-	-	μA
	STROBE			-3.0	-	-	
	CLOCK			-3.0	-	-	
	DATAIN			-0.5	-	-	
Drive output voltage(Low)		V_{DOL}	V_{DD}=3V I_{DOL}=60mA	-	0.7	0.9	V
Drive Leak current		I_{LEAK}	V_{OH}=8V	-	-	1.0	μA/dot
Logic supply current		I_{dd}	f_{CLK}=8MHz DI=1/2f_{CLK}	-	21	60	mA
Logic supply current (Non-Operation)		Is	DATA IN/CLOCK = GND Other logic signal open	-	-	150	μA

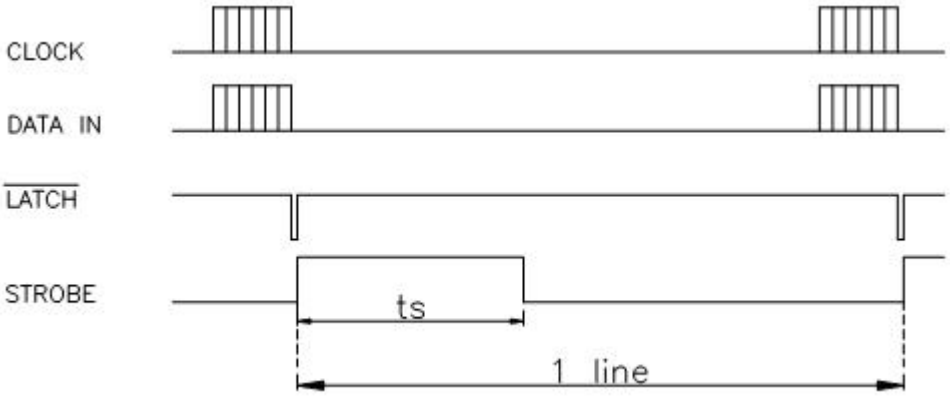
Note： Each STROBE includes pull-down resistance of 50KΩ±50%.

2.4.5 Timing Characteristics

Parameter	Symbol	Ratings			
		Min.	Typ.	Max.	Unit.
Clock frequency	f_{CLK}			10	MHZ
Clock pulse width	$t_w(T)$	40			ns
Data setup time	$t_{su}(D)$	40			ns
Data hold time	$t_h(D)$	40			ns
Latch setup time	$t_{su}(LA)$	100			ns
Latch pulse width	$t_w(LA)$	100			ns
Latch to Strobe setup time	$t_{su}(STB)$	100			ns
Strobe to Latch setup time	$t_h(STB)$	100			ns
Clock to Data out delay time	$t_d(SO)$			50	ns
Strobe to driver output delay time	$t_d(DO)r$			13.0	µs
	$t_d(DO)f$			13.0	µs



2.4.6 Timing Chart



*： While printing, data transmission is possible.

2.4.7 Equation

Calculate the printing energy using this equation：

$$E_O = I_o^2 \overline{R} t_s = \frac{(VH - V_{com})^2 \cdot \overline{R} \cdot t_s}{(\overline{R} + R_{ic})^2}$$

R_{ic} =11.7Ω : Driver IC “ON” resistance

t_s : Strobe pulse width

VH : Head voltage

$\overline{R}$: Heater average resistance

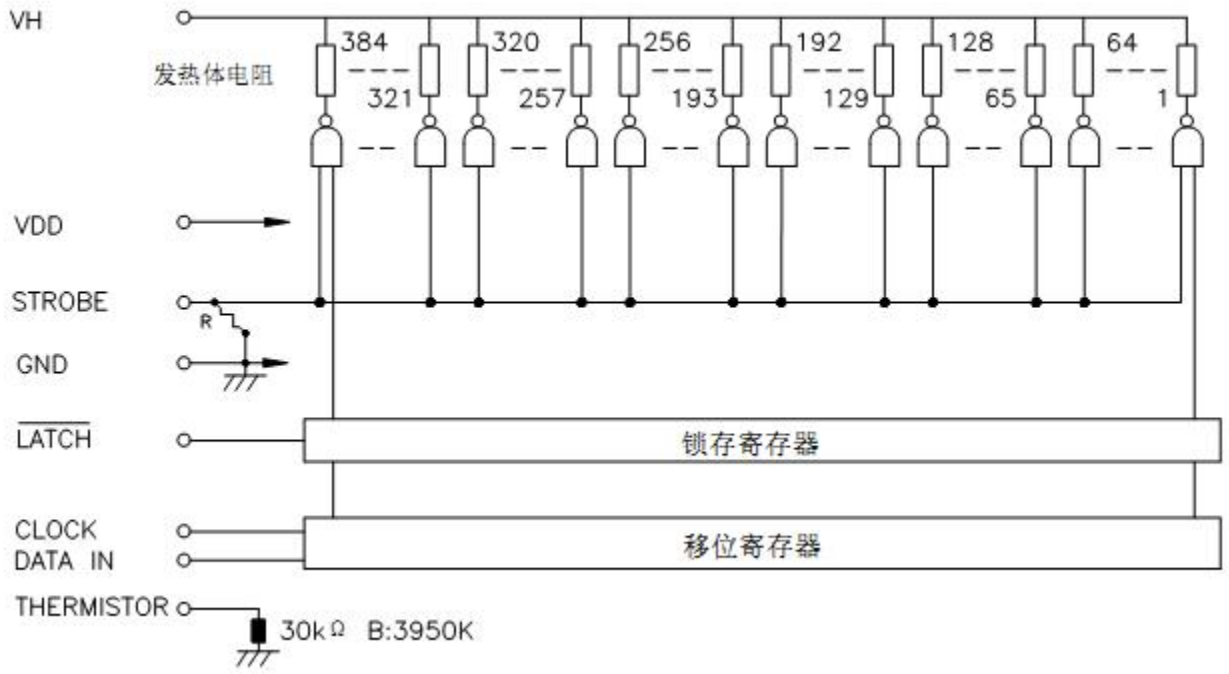
V_{com} =0.3 V

2.4.8 Thermistor Resistance

$$R_{25} = 30\text{K}\,\Omega \pm 5\%,\ \text{B}_{\text{CONST}} = 3950\text{kelvin} \pm 3\%,\ R = R_{25} e^{B(1/T - 1/T_{25})}$$

Temperature (° C)	Thermistor Resistance (R)		
	Min.(KΩ)	Typ.(KΩ)	Max.(KΩ)
-40	717	843	989
-35	535	623	723
-30	405	466	535
-25	308	352	400
-20	238	269	303
-15	185	208	232
-10	145	161	178
-5	113	124	137
0	88.7	96.8	105
5	69.9	75.7	81.7
10	55.4	59.5	63.8
15	44.1	47.1	50.1
20	35.4	37.5	39.6
25	28.5	30	31.5
30	22.8	24.2	25.5
35	18.3	19.6	20.8
40	14.9	15.9	17.1
45	12.1	13.1	14.1
50	9.92	10.8	11.7
55	8.16	8.91	9.7
60	6.76	7.41	8.12
65	5.62	6.2	6.83
70	4.7	5.21	5.77
75	3.95	4.4	4.9
80	3.34	3.74	4.18

2.4.9 Structure Figure



STROBE No.	Dot No.	Number of Dots
1	1～384	384

2.4.10 Operating Precautions

In order to prevent the printer head heater element overheating or burned up, when we designing products, pay attention to the points as follows:

- **In hardware terms:**
  1) When the power on, the order should be VDD→VH.
  2) When the power is on or stand by, make sure that the STROBE signal is in invalid state.
  3) Make sure if program is abnormal (such as system halted), VH voltage should be shut off automatically.
  4) During the printing, Detecting thermistor temperature, make sure that the thermal printer head (TPH) is not overheated.
- **In firmware terms:**
  1) STROBE time should not be too long.
  2) In the following two cases, do not start:
  ① when paper jammed; ② When the paper is out.
  3) When the power is on or each printing task completed, it is recommended to send blank data to the mechanism, so it can prevent the printer head from damaged if there are some hardware failure on the control board.
  4) Over-temperature protection:The printer stops working when heating temperature is greater than 75℃,and start working again when the temperature down to 60℃.

2.5 Pin Assignment

Pin	Name	Function
1	$\overline{A}$	Stepping motor excitation signal $\overline{A}$
2	A	Stepping motor excitation signal A
3	B	Stepping motor excitation signal B
4	$\overline{B}$	Stepping motor excitation signal $\overline{B}$
5	GPS	Ground power supply for thermal head
6	VPS	Emitter for photo interrupter
7	PS	Cathode for photo interrupter
8	VH0	Head drive power
9	VH1	Head drive power
10	$\overline{LATCH}$	Data latch
11	GND0	Ground power supply for thermal head
12	GND1	Ground power supply for thermal head
13	GND2	Ground power supply for thermal head
14	THERMISTOR	Thermally sensitive resistor input terminal
15	STROBE	Thermal head energizing control signal
16	VDD	Logic power
17	GND3	Ground power supply for thermal head
18	GND4	Ground power supply for thermal head
19	GND5	Ground power supply for thermal head
20	CLOCK	Asynchronous clock for communication
21	DATA-IN	Data in
22	VH2	Head drive power
23	VH3	Head drive power
24	VH4	Head drive power

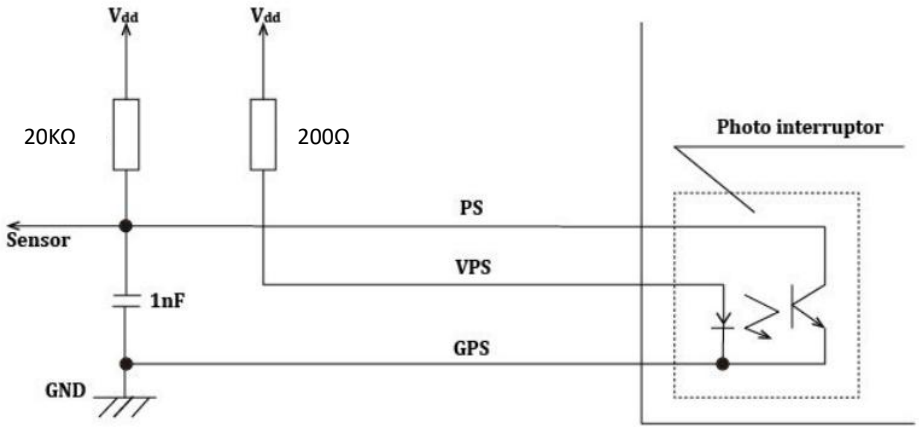
2.6 Photo Interrupter Specification

Item	Specification
Model Name	ITR1204SR10A-TR
Supplier	Everlight Electronics Co,.Ltd
PRT Material No.	01.D.G.11000024

PT48GE has a reflective sensor. As show in the figure below, when the platen released or paper out,no infrared light will be reflected,the output is high. When everything is normal, the sensor will output low level.

In the diagram the VDD is 3.3V.

When the paper out or platen released, do not start printing.



Absolute Maximum Ratings (Ta=25℃)

Parameter		Symbol	Ratings	Unit
Input	Power Dissipation at(or below) 25℃ Free Air Temperature	P_d	75	mW
	Reverse Voltage	V_R	6	V
	Forward Current	I_F	50	mA
Output	Collector Power Dissipation	P_C	75	mW
	Collector Current	I_C	20	mA
	Collector-Emitter Voltage	B V_{CEO}	30	V
	Emitter-Collector Voltage	B V_{ECO}	5	V
Operating Temperature		T_{opr}	-25~+85	℃
Storage Temperature		T_{stg}	-40~+100	℃
Lead Soldering Temperature (*1)		T_{sol}	260	℃

(*1) t≤5 Sec

Electro-Optical Characteristics (Ta=25℃)

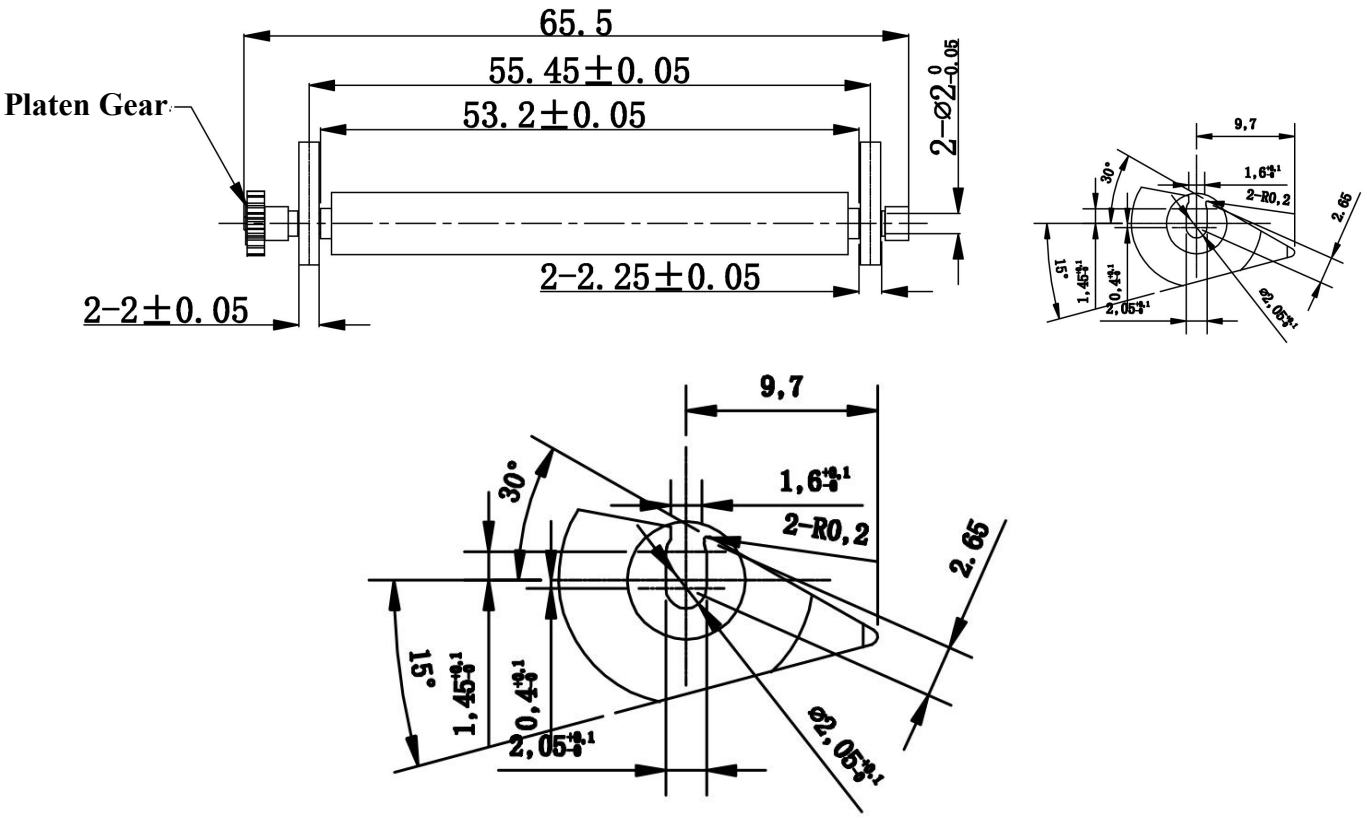
Parameter		Symbol	Min	Typ.	Max.	Unit	Conditions
Input	Forward Voltage	V_F	---	1.25	1.5	V	I_F=4mA
	Reverse Current	I_R	---	---	10	μA	V_R=6V
	Peak Wavelength	λ_P	---	940	---	nm	I_F=20mA
Output	Dark Current	I_{CEO}	---	---	0.1	μA	V_{CE}=10V
Transfer Characteristics	Light Current	I_C(ON)	60	---	130	μA	V_{CE}=2V I_F=4mA
	Leakage Current *	I_{CEOD}	---	---	1	μA	V_{CE}=2V I_F=2mA
	Rise time	tr	---	15	---	μs	V_{CE}=2V I_C=0.1mA R_L=1000Ω
	Fall time	tf	---	15	---	μs	

*: Leakage current may be influenced by surroundings.

CHAPTER 3 CASING DESIGN GUIDE

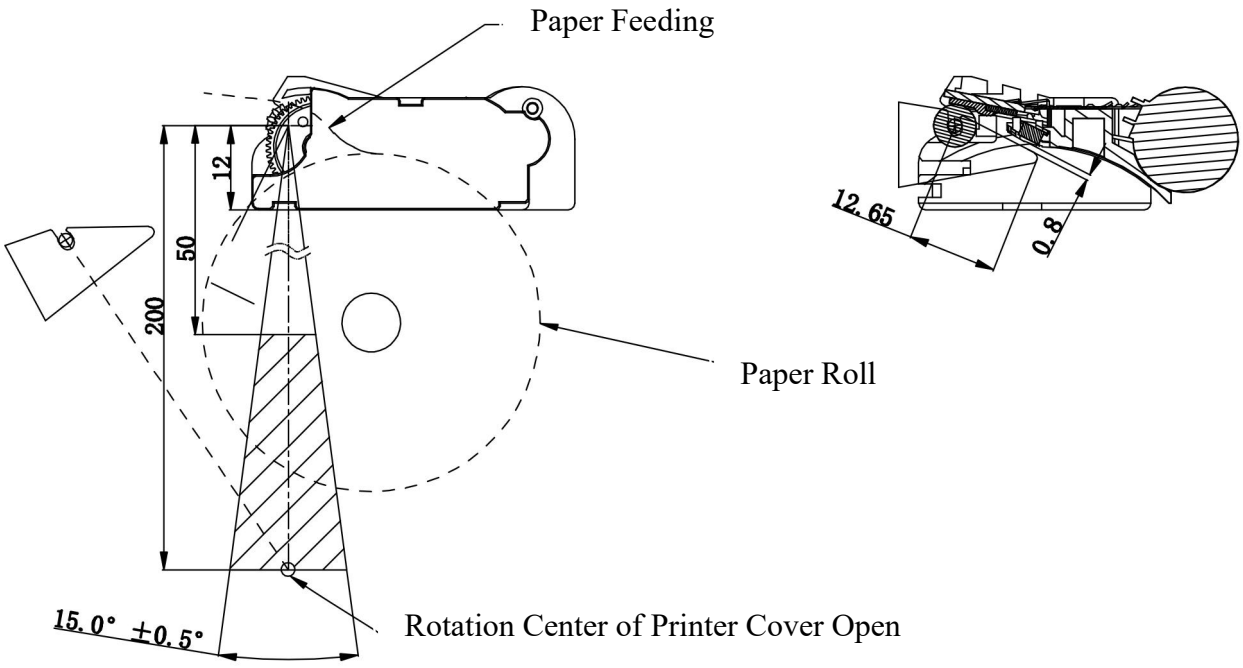
3.1 Platen Structure Dimensions

[Unit： mm]



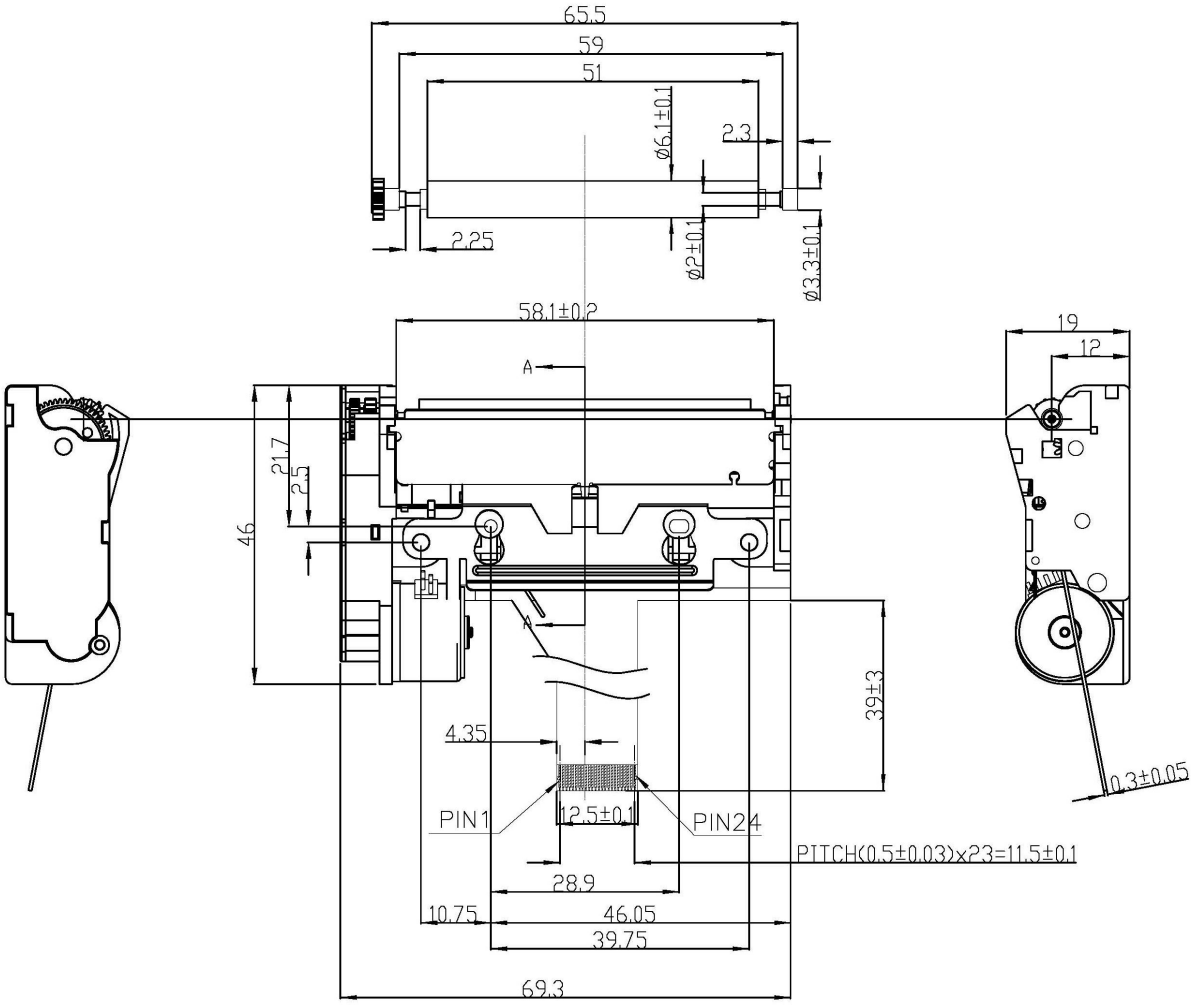
The suggested rotation center diagram of the printer cover open:

[Unit： mm]



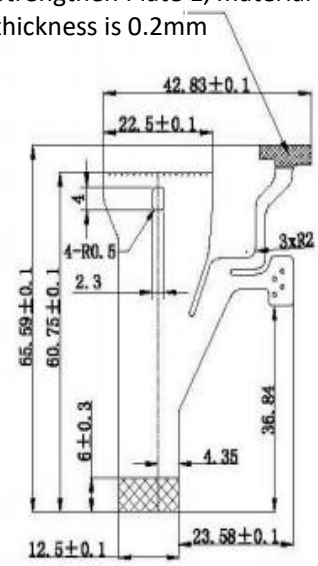
3.2 Thermal Printer Mechanism Structure Dimensions

[Unit： mm]
General Calibration: ±0.5mm

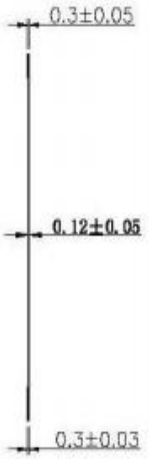


3.3 FPC Dimensions

Strengthen Plate 1, material is PI, thickness is 0.2mm

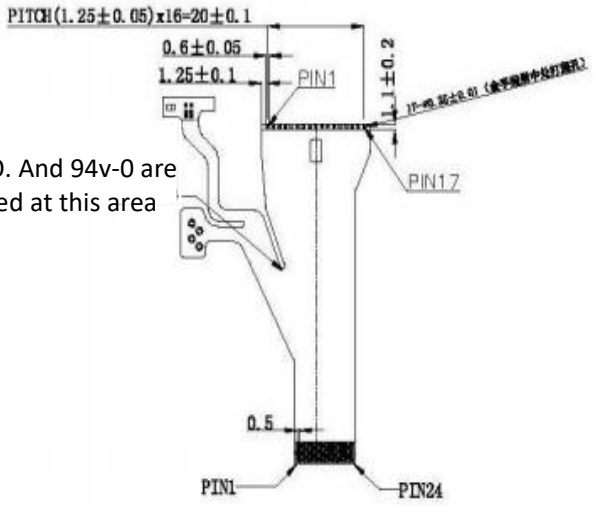


Back View



Side View

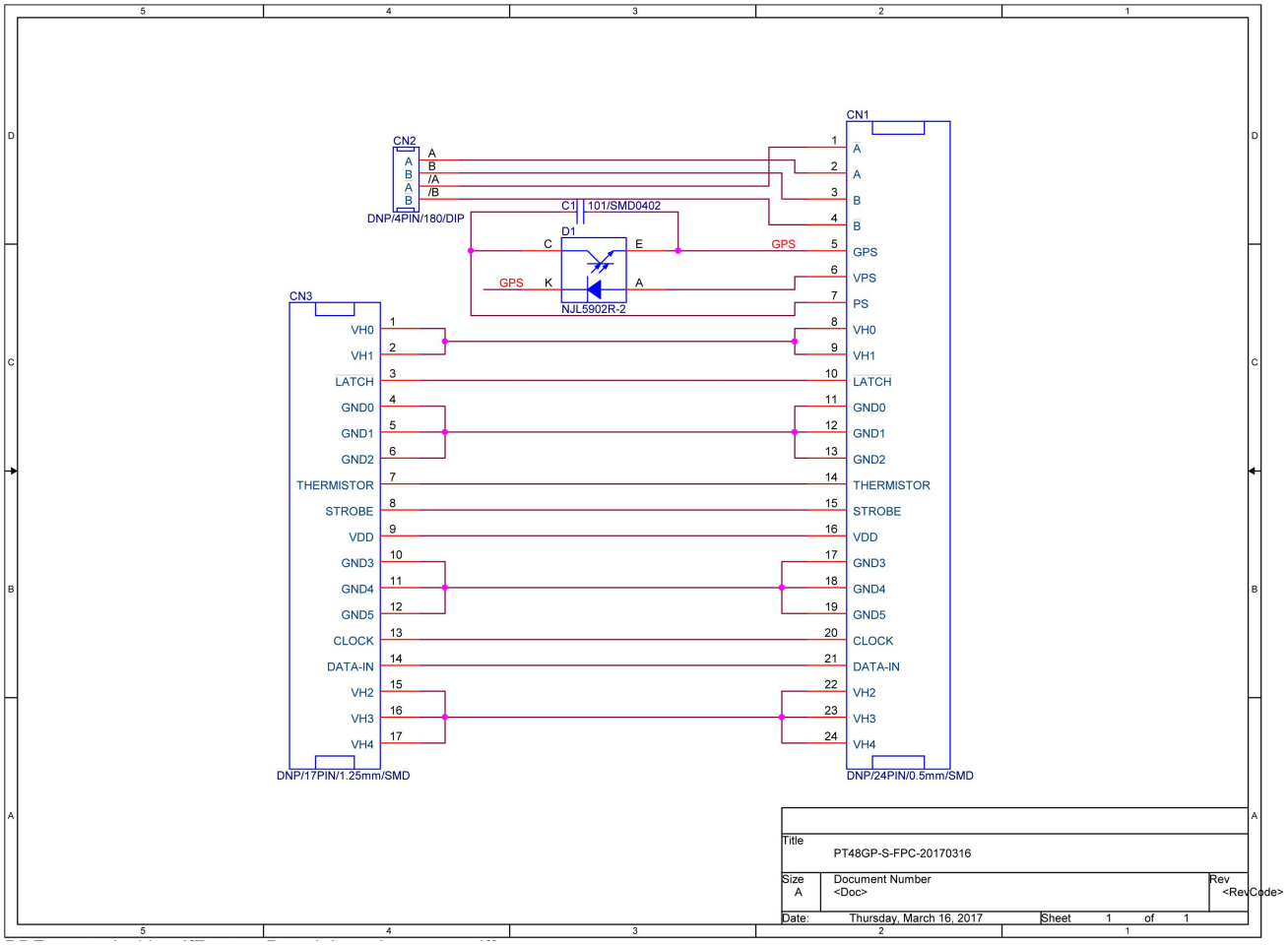
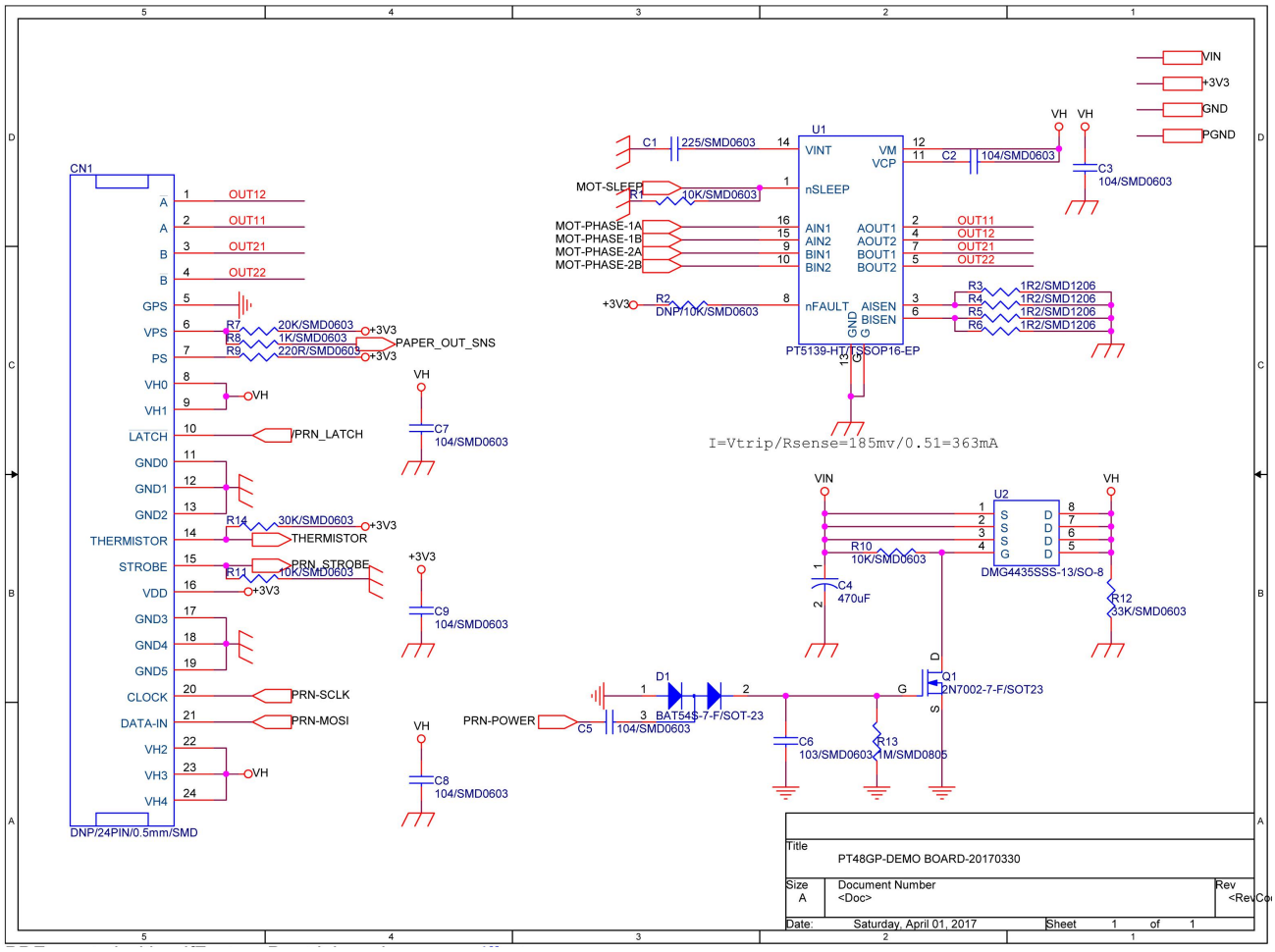
UL NO. And 94v-0 are lettered at this area



Front View

APPENDIX

Circuit Diagram



Recommended Circuit: